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(54) **AIR FILTRATION DEVICE**

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(51) **Int. Cl.**[7] **B01D 35/30**; B01D 35/43
(52) **U.S. Cl.** **55/471**; 55/495; 55/503
(58) **Field of Search** 96/418, 424; 55/471, 55/495, 503

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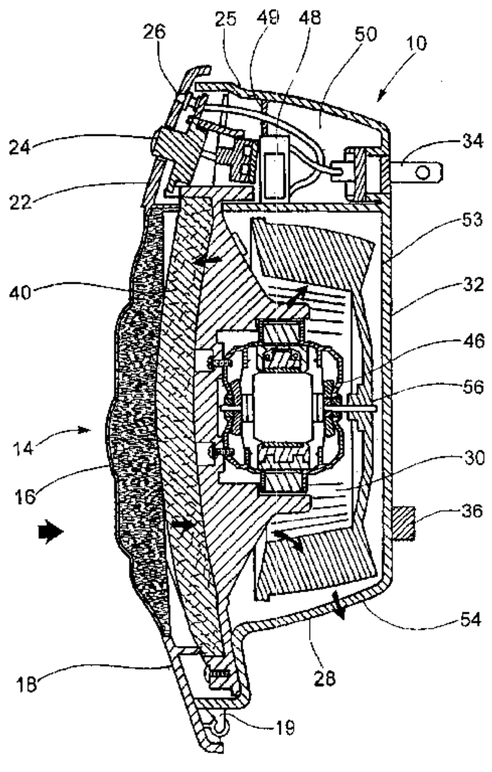
(57) **ABSTRACT**

An air filtration device for intake of atmospheric air, removal of contaminants from the atmospheric air, expulsion of filtered air, includes a housing configured for application directly to an electrical outlet and provides air intake from the front surface of the housing and air expulsion from the side of the housing to utilize a wall surface to disperse the filtered air. An indicator is provided to communicate that a filter should be changed, and a filter orientation system is provided to allow proper orientation of the filter with respect to air flow.

1 Claim, 10 Drawing Sheets



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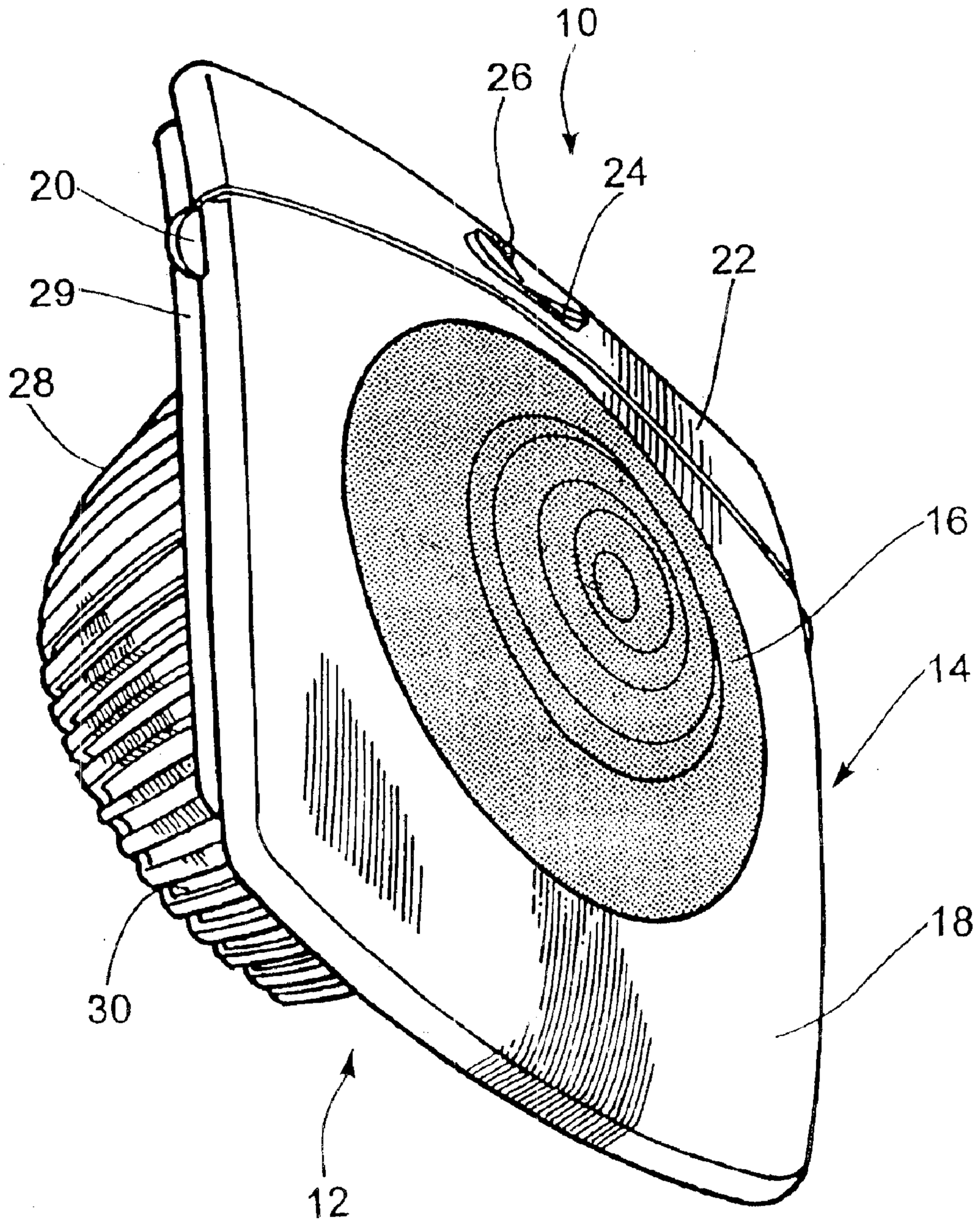

Fig. 1

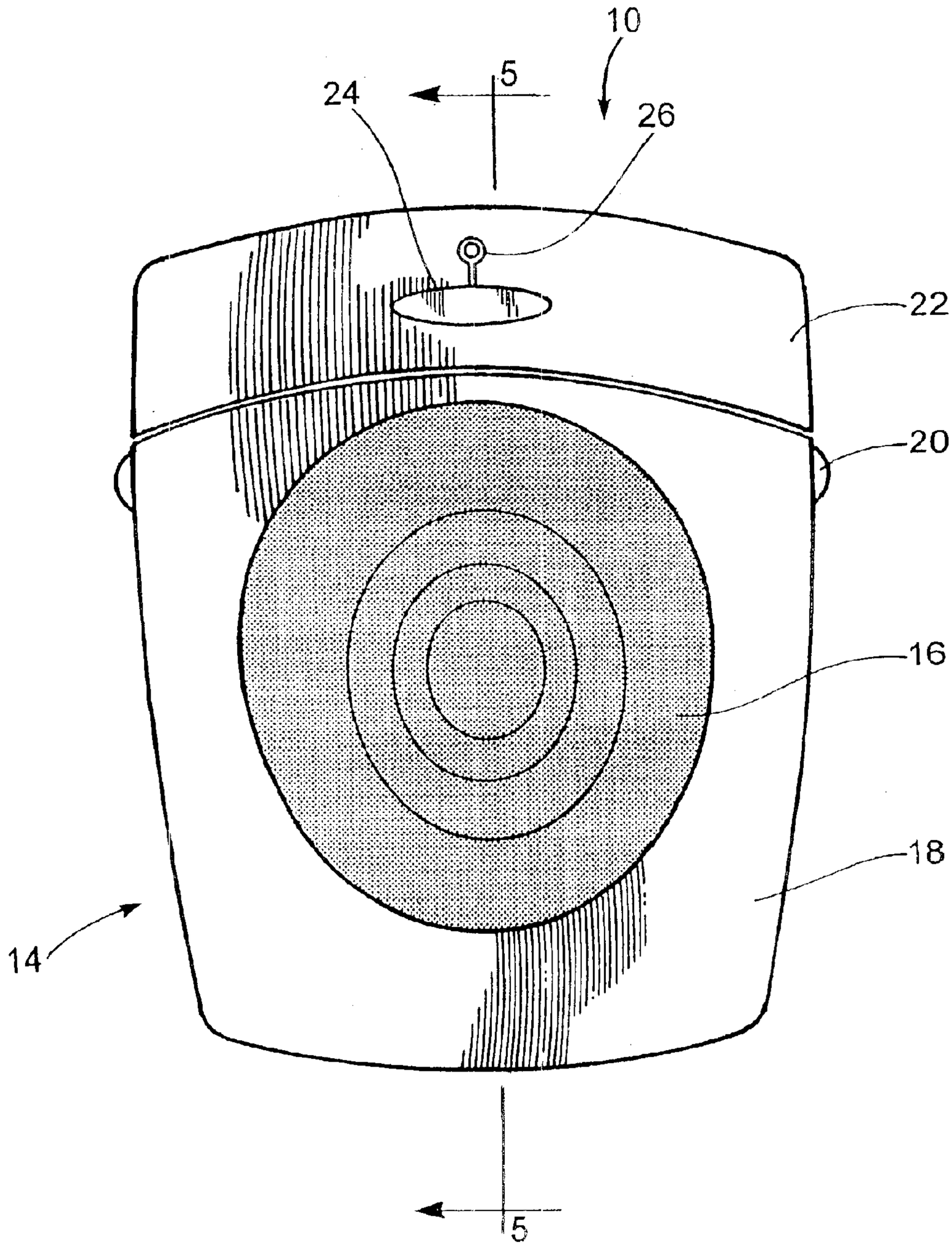

Fig. 2

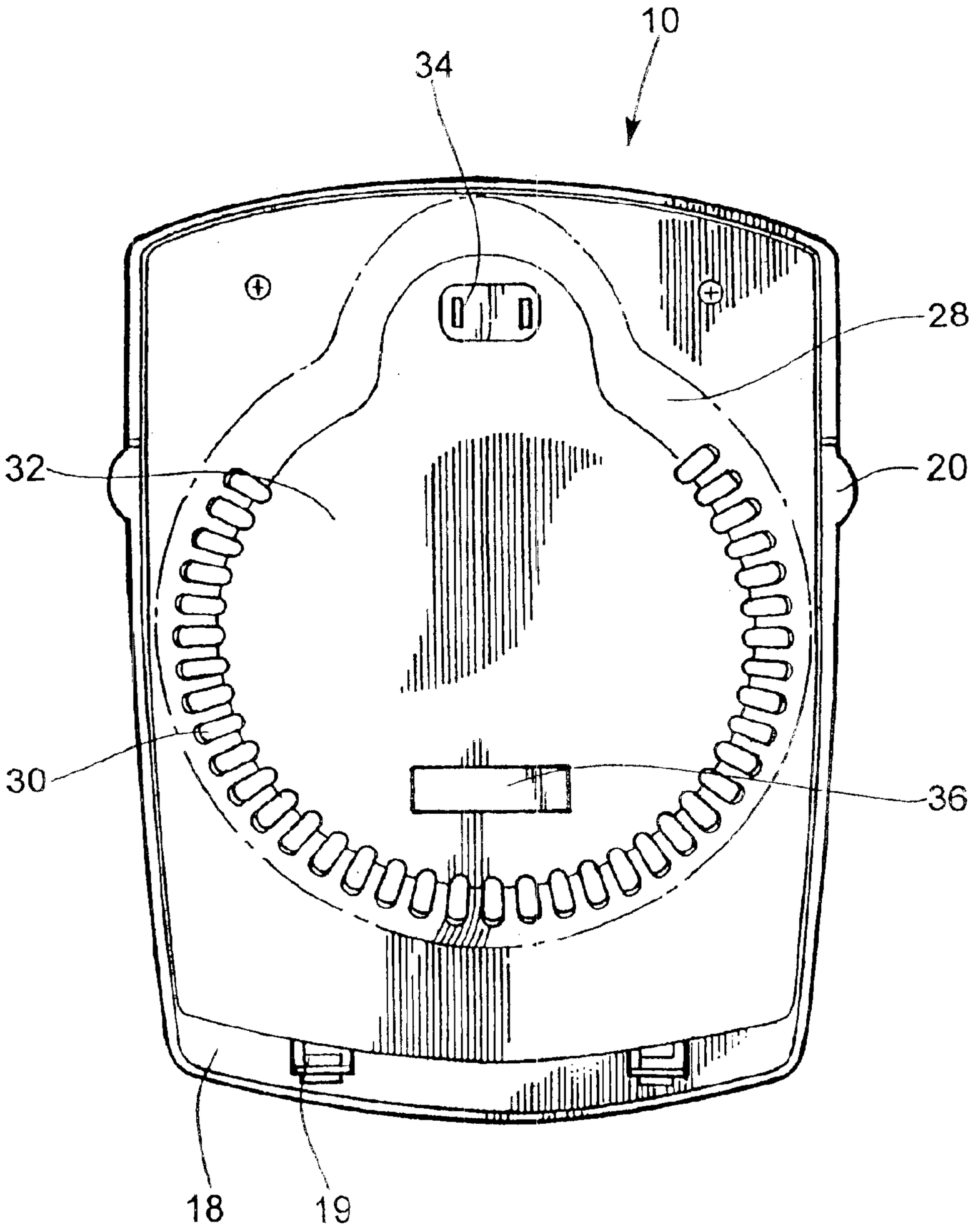

Fig. 3

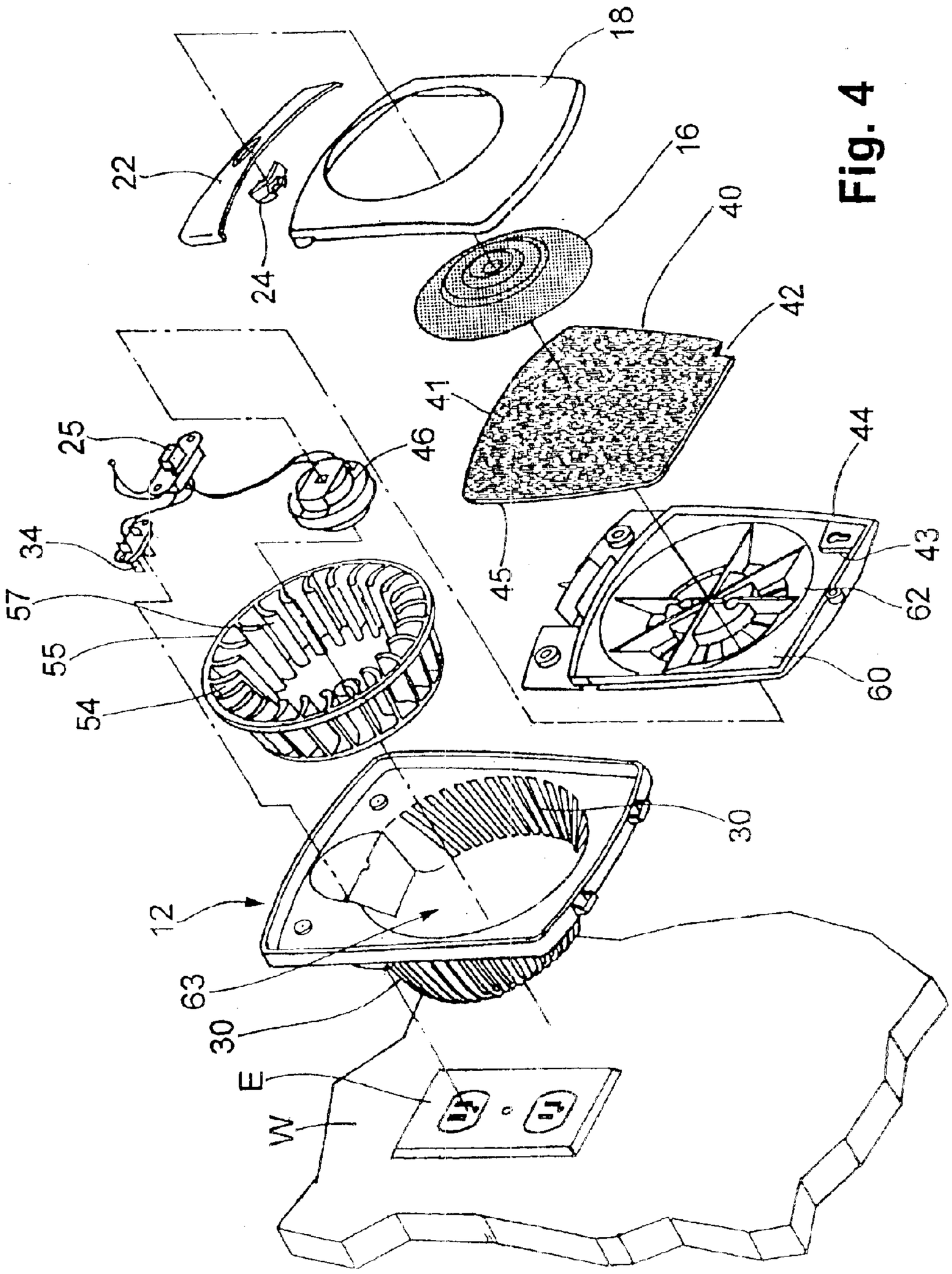

Fig. 4

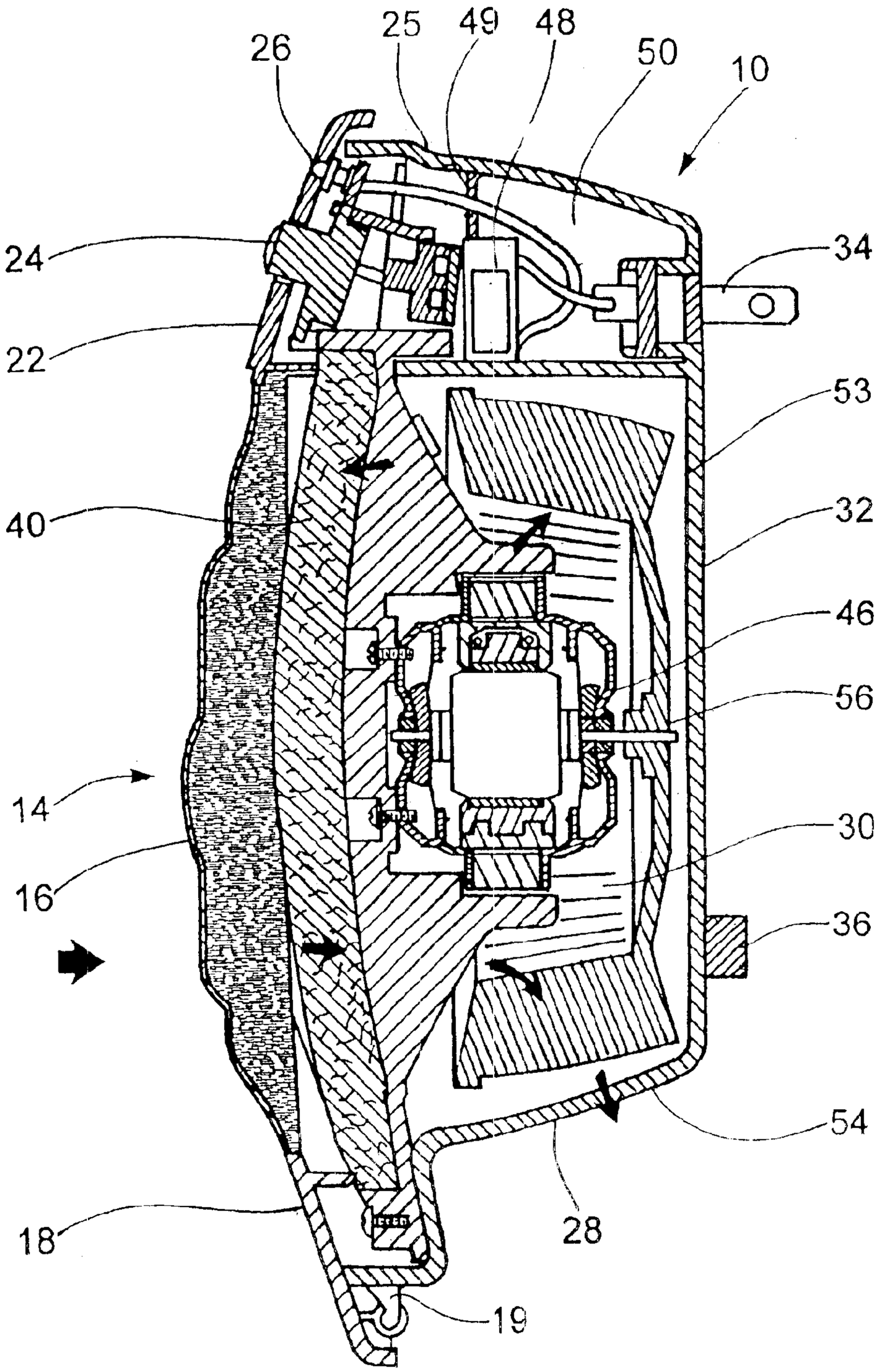

Fig. 5

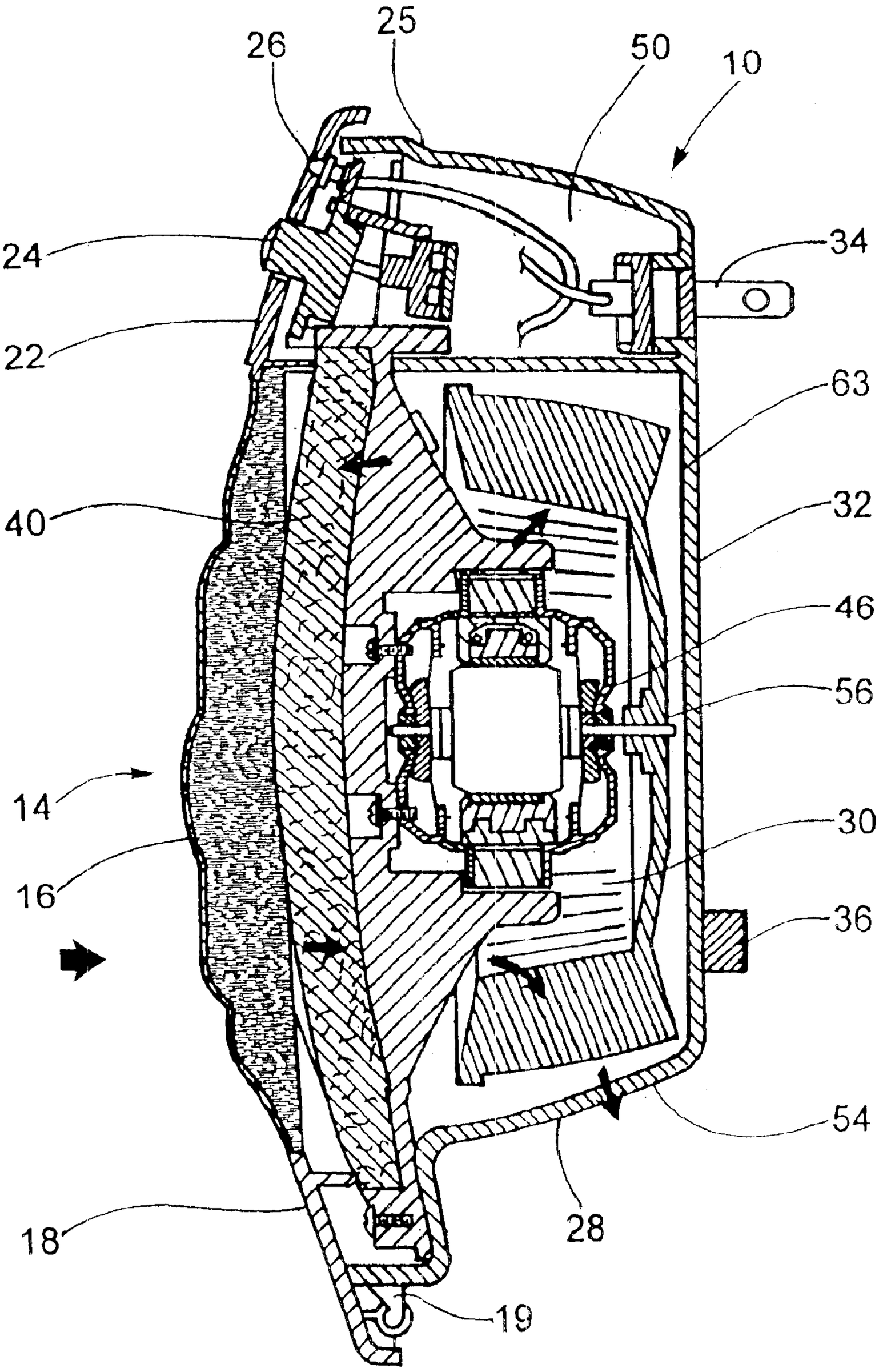

Fig. 6

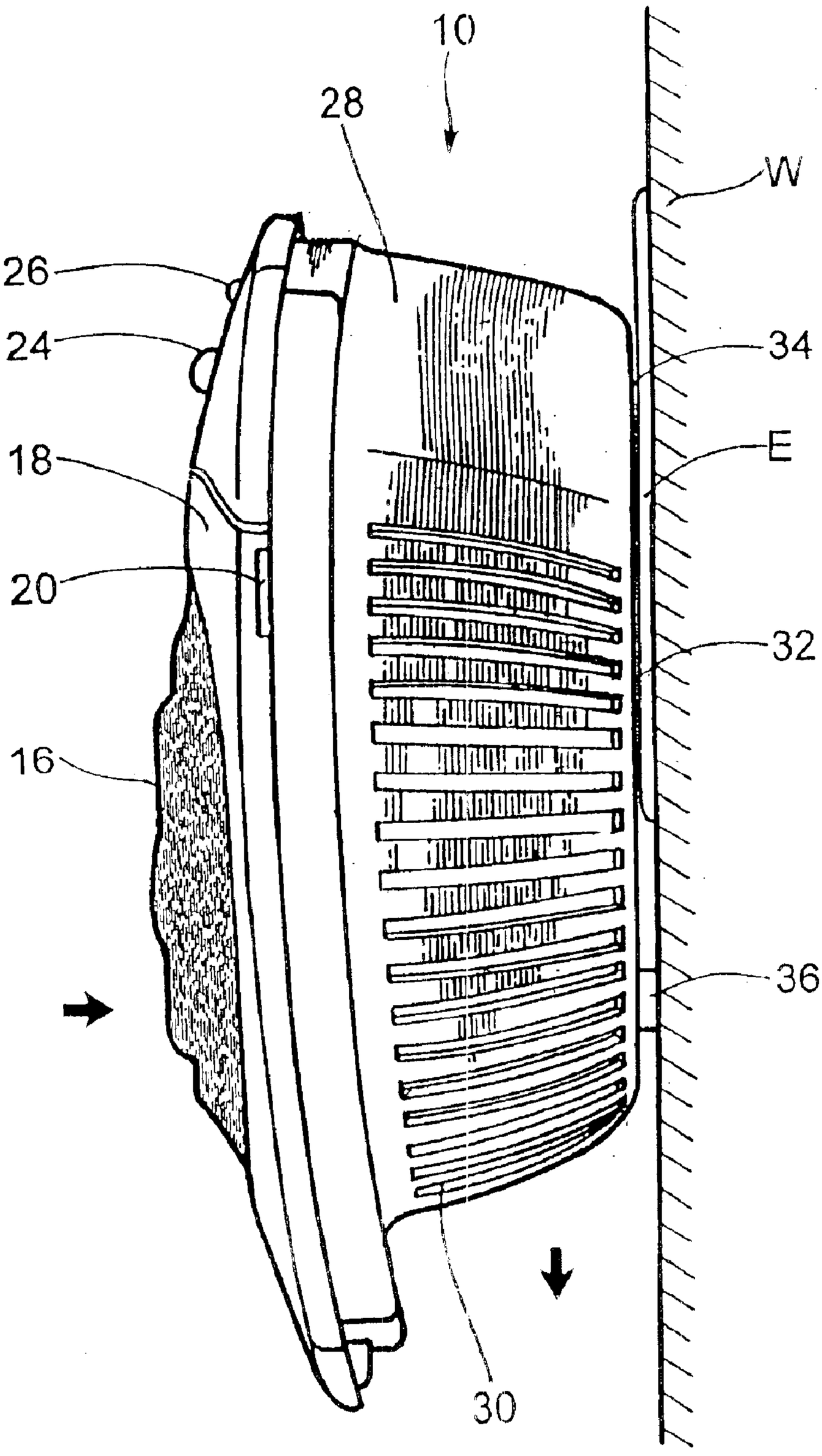

Fig. 7

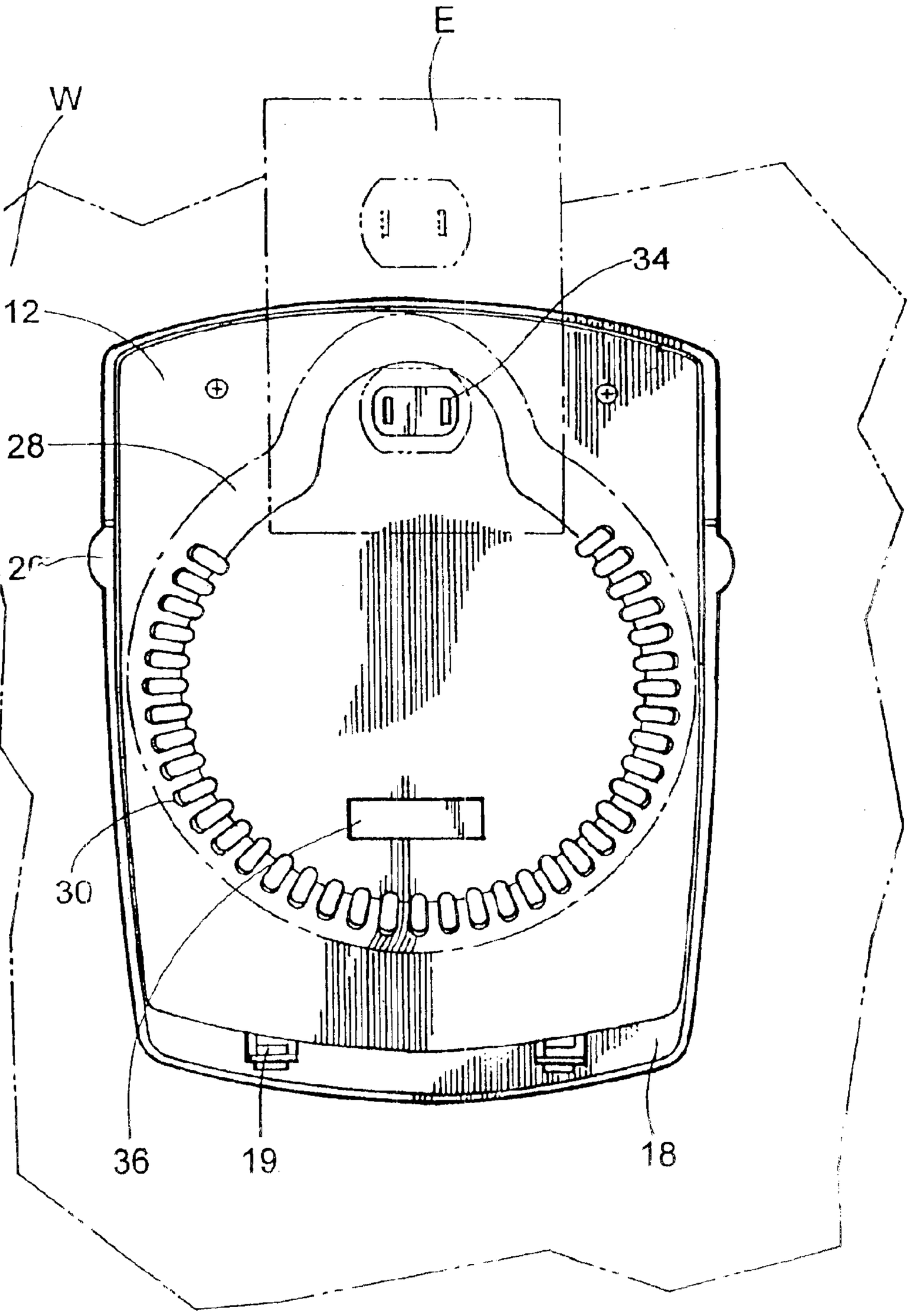

Fig. 8

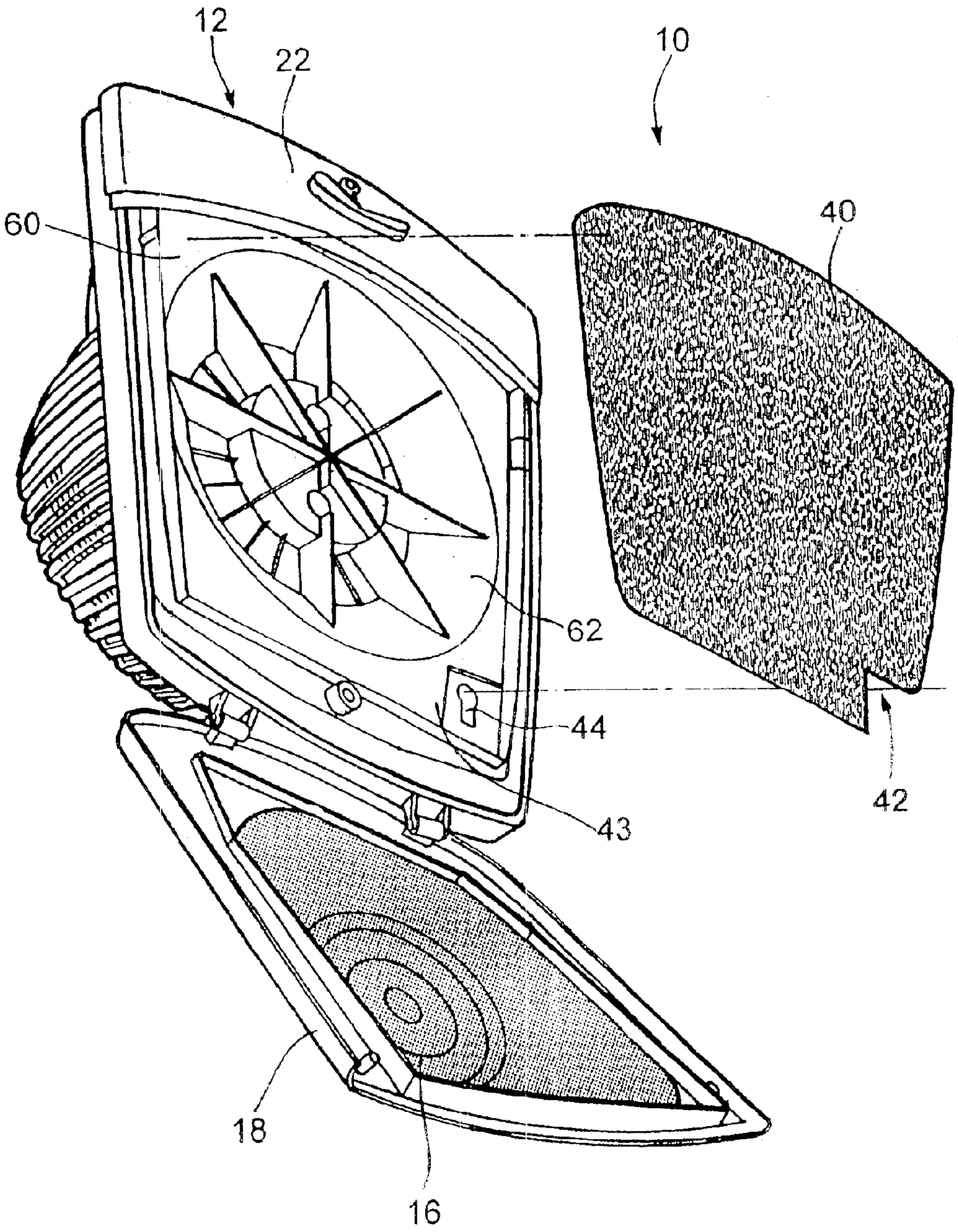

Fig. 9

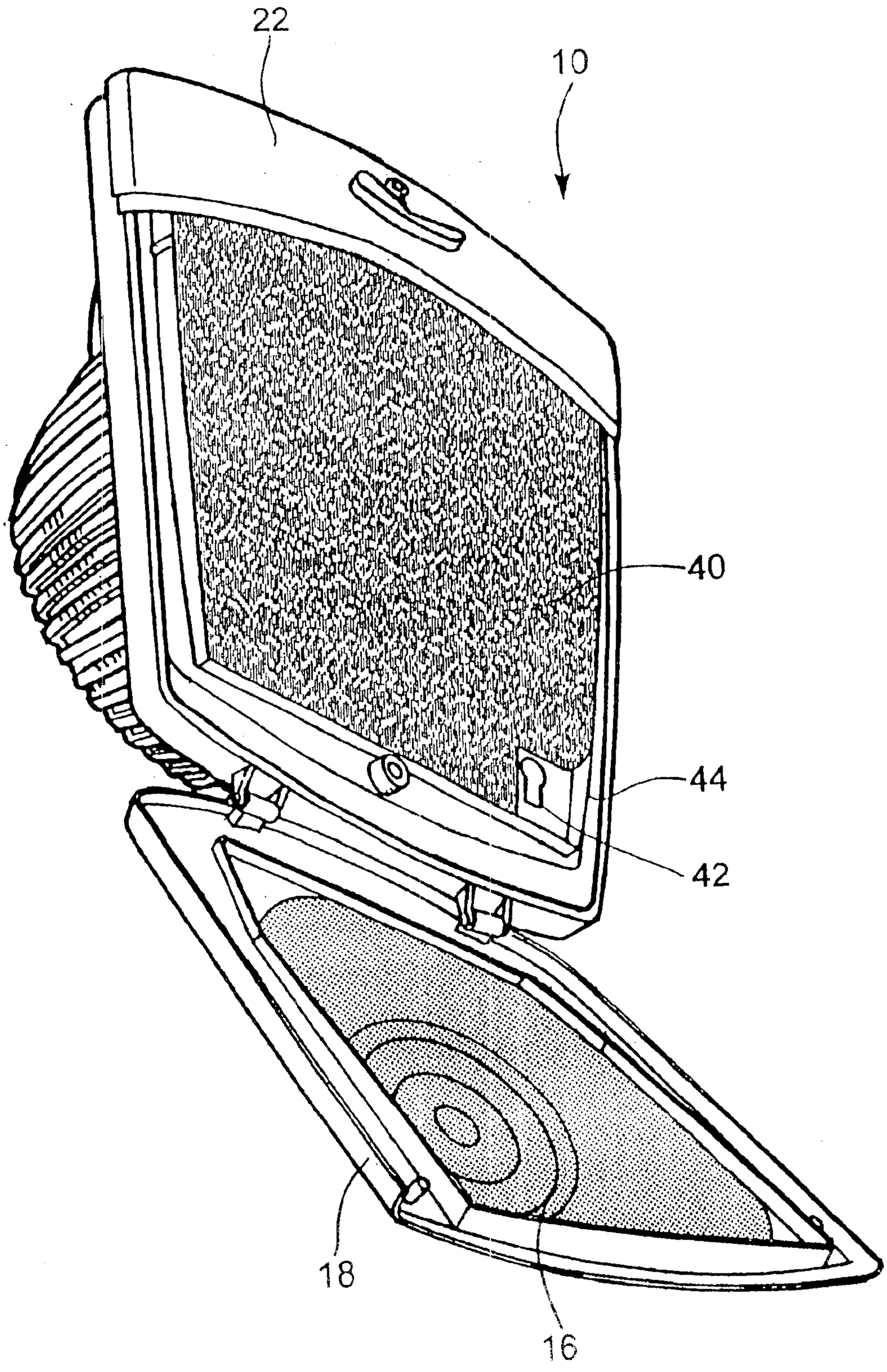

Fig. 10

AIR FILTRATION DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

This patent application is a continuation of U.S. patent application Ser. No. 10/288,646, filed Nov. 4, 2002, now U.S. Pat. No. 6,712,889, now abandoned, which is a continuation of U.S. Patent application Ser. No. 10,010,677, now U.S. patent application Ser. No. 10/176,835, filed Jun. 21, 2002, which is a continuation of U.S. Pat. application Ser. No 09/563,821, now U.S. Pat. No. 6,447,587 B1, filed Dec. 6, 2001, which is a continuation of U.S. Pat. No. 6,328,791 B1, filed May 3, 2000.

BACKGROUND OF THE INVENTION

The present invention relates broadly to air filtration apparatus and, more particularly, to an air filtration device that is configured for abutment against an electrical outlet providing operational power for the device, with atmospheric air flowing into an intake on the front surface of the device, and filtered air being emitted through vents provided on the side of the device.

As the atmosphere in general becomes more polluted and the general population becomes more aware of discomforts associated with dirty air, air filtration devices of all shapes, types and sizes have become more popular. One type of air filtration device provides a small fan for use in a smoky environment. These devices typically will include an electric fan contained in a small housing for tabletop use, with a filter through which the air is directed for removal of smoke and other such contaminants. These small fans are useful for removing odors and contaminants from a confined space, since they typically take up little space themselves and move a relatively small volume of air.

Such current designs, while effective, leave room for improvement in the areas of noise control, air dispersion and filter management.

SUMMARY OF THE INVENTION

An air filtration device is provided for intake of atmospheric air, assistance in removal of contaminants from the atmospheric air, expulsion of filtered air and configured for operational association with a generally vertically oriented surface. The device includes a housing defining an air flow path therethrough having a front surface, at least one side surface and a rear surface; at least one air inlet formed in the front surface of the housing; and at least one air outlet formed in the housing intermediate the front surface and the rear surface, for cooperation of the air outlet with a generally vertical surface to which the air filtration device is associated for enhanced dispersion of filtered air expelled through the air outlet. A filter is mounted to the housing in the air flow path and an impeller is provided for moving air through the housing along the air flow path from the at least one air inlet to the at least one air outlet, with the impeller being mounted to the housing.

The air outlet may be formed on the at least one side surface and the air flow path may be defined from the air inlet on the front surface through the filter, through the impeller and outwardly through the air outlet. Also, the side surface may be curved and the air outlet may be formed as a series of vents along the curvature of the side surface.

The air filtration device may further include a bumper member attached to the rear surface of the housing for abutment with a generally vertical surface to which the air filtration device is associated for orientation of the device with the vertical surface. The bumper member may also be formed from resilient material for enhanced noise reduction when the air filtration device is in operation. The filter can be formed as a generally planar member selectively removable from the housing and can include a notch formed therein for directing insertion of the filter in a correct orientation with respect to the air flow path. The housing may include a locating surface formed thereon and corresponding with the notch in the filter to orient the filter in the housing. The housing may also include an icon formed thereon at a position corresponding with the notch in the filter when the filter is inserted in the housing for enhanced visual indication of proper filter orientation.

The air filtration device can include an electric motor for driving the impeller and a pair of electric prongs extending outwardly from the rear surface of the housing for operational engagement with an electrical wall outlet for supplying electric power to the electric motor. The pair of electrical prongs can be configured with each prong in the pair having substantially the same dimensions, so that said air filtration device may be connected to an electrical outlet without regard to the dimensional differences between the socket openings.

The air filtration device may further include an indicator for communicating that the filter should be changed, the indicator providing information after a predetermined period of operation of the air filtration device has passed. The impeller may be driven electrically and the indicator can include an electric timer circuit operationally associated with the impeller for determining when a predetermined time of impeller operation has passed.

A lamp may be mounted to the housing for illumination when the impeller is in operation, with the lamp being in electrical communication with the electric timer circuit and configured to provide pulsating illumination when a predetermined time of impeller operation has passed. A reset switch can be provided in electrical communication with the electric timer circuit to selectively reset the electric timer circuit to a zero operational time setting.

It will be understood by those skilled in the art that variations on that which is described above may be achieved by addition or omission of the features of the features above described.

Accordingly, an air filtration device is provided for intake of atmospheric air, assistance in removal of contaminants from the atmospheric air, expulsion of filtered air and configured for operational association with a generally vertically oriented surface, and includes a housing for abutting attachment to an electrical outlet, the housing defining an air flow path therethrough and having a front surface, at least one side surface and a rear surface; at least one air inlet formed in the housing; at least one air outlet formed in the housing intermediate the front surface and the rear surface; a filter mounted to the housing in the air flow path; an electrically driven impeller for moving air through the housing along the air flow path from the at least one air inlet to the at least one air outlet, with the impeller being mounted to the housing; and a pair of electric prongs extending outwardly from the rear surface for operational engagement with an electrical wall outlet for supplying electric power to the impeller. The pair of electrical prongs can be configured with each prong in the pair having substantially the same dimensions, so that said air filtration device may be connected to an electrical outlet without regard to the dimensional differences between the socket openings. A bumper

member is attached to the rear surface of the housing for abutment with a generally vertical surface to which the bumper member may abut for orienting the device with the vertical surface. The bumper may be formed from resilient material for damping vibrations received from the housing to provide enhanced noise reduction when the air filtration device is in operation.

The air filtration device includes an air inlet that is formed on the front surface of the housing and the air flow path is defined from the air inlet on the front surface through the filter, through the impeller and outwardly through the air outlet. The filter may be formed as a generally planar member selectively removable from the housing and includes a notch formed therein for directing insertion of the filter in a correct orientation with respect to the air flow path. The housing may include a locating surface formed thereon and corresponding with the notch in the filter to orient the filter in the housing. The housing may include an icon formed at a position corresponding with the notch in the filter when the filter is inserted in the housing for enhanced visual indication of proper filter orientation.

The air filtration device may include an indicator for communicating that the filter should be changed, the indicator providing information after a predetermined period of operation of the air filtration device has passed. The impeller may be driven electrically and the indicator may include an electric timer circuit operationally engaged with the impeller for determining when a predetermined time of impeller operation has passed. The air filtration device also can include a lamp mounted to the housing for illumination when the impeller is in operation, the lamp being in electrical communication with the electric timer circuit and configured to provide pulsating illumination when a predetermined time of impeller operation has passed. A reset switch can be provided in electrical communication with the electric timer circuit to selectively reset the electric timer circuit to a zero operational time setting.

It should also be understood that the above-described features may be combined under a single, full-featured unit. In that regard, an air filtration device for intake of atmospheric air, removal of contaminants from the atmospheric air, expulsion of filtered air and configured for operational association with a generally vertically oriented surface, includes a housing for abutting attachment to an electrical outlet, the housing defining an air flow path therethrough and having a front surface, a curved side surface and a rear surface; at least one air inlet formed in the front surface of the housing; and a series of vents formed in the side surface intermediate the front surface and the rear surface, for cooperation of the vents with a generally vertical surface to which the air filtration device is associated for enhanced dispersion of filtered air expelled through the vents. A filter is mounted to the housing intermediate the at least one air inlet and the at least one air outlet, with the filter being formed as a generally planar member selectively removable from the housing and including a notch formed therein for directing insertion of the filter in a correct orientation with respect to the air flow path. The housing may include a locating surface formed thereon and corresponding with the notch in the filter to orient the filter in the housing. An electrically driven impeller is provided for moving air through the housing along the air flow path from the at least one air inlet to the vents, with the impeller being mounted to the housing. A pair of electric prongs extends outwardly from the rear surface for operational engagement with an electrical wall outlet for supplying electric power to the impeller. The pair of electrical prongs can be configured with each prong in the pair having substantially the same dimensions, so that the air filtration device may be connected to an electrical outlet without regard to the dimensional differences between the socket openings. A bumper member is attached to the rear surface of the housing for abutment with a generally vertical surface to which the bumper member may abut for orienting the device with the vertical surface. The bumper member may be formed from resilient material for damping vibrations received from the housing for enhanced noise reduction when the air filtration device is in operation.

The air filtration device may include an indicator providing information after a predetermined time period of operation of the air filtration device has passed. The indicator may include an electric timer circuit, as described above, to determine how long the impeller has been in operation and, when the time period has passed, an indicator lamp provides a pulsing illumination. The electric timer circuit may also be provided with a reset switch to selectively reset the electric timer circuit to a zero operational time setting.

By the above, the present invention provides an air filtration device that will plug directly into an outlet and utilize the wall behind the device for dispersion of filtered air, while directing air intake from a central source. The present invention also provides a handy visual indication of when the filter is placed in proper orientation with respect to air flow. Further, the device provides reduced noise by damping vibrations transmitted from the housing to the wall against which the device is mounted.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of an air filtration device according to the preferred embodiment of the present invention;

FIG. **2** is a front view of the air filtration device illustrated in FIG. **1**;

FIG. **3** is a rear view of the air filtration device illustrated in FIG. **1**;

FIG. **4** is an exploded view of the air filtration device illustrated in FIG. **1**;

FIG. **5** is a side cutaway view of the air filtration device taken along line **5**—**5** in FIG. **2**;

FIG. **6** is a side cutaway view of the air filtration device similar to the device in FIG. **5**, illustrating an alternate embodiment without a timer circuit;

FIG. **7** is a side view of the air filtration device illustrated in FIG. **1**, shown mounted to a wall;

FIG. **8** is a rear view of the air filtration device as illustrated in FIG. **3**, shown mounted to a wall;

FIG. **9** is a front perspective view of the air filtration device illustrating filter placement; and

FIG. **10** is a front perspective view of the air filtration device illustrated in FIG. **9**, with the filter inserted properly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to the drawings and, more particularly to FIGS. **1**, **2** and **3**, an air filtration device for intake of atmospheric air, filtration of the atmospheric air and emission of filtered air is illustrated generally at **10** and includes a housing **12**. The housing **12** includes a generally curved side wall **28** fixed to a generally flat front portion **29**. A generally planar door **18** is fixed to the flat front portion **29**, using hinges **19** as seen in FIG. **3**. Referring back to FIG. **1**,

the door **18** includes a front surface **14** and a generally circular perforated air inlet grill **16**. Tabs **20** are provided on each side of the door as seen in FIGS. **1** and **2**, for ease of opening for filter replacement, as will be seen in greater detail hereinafter. The door covers approximately 80% of the front surface of the device **10**. The remainder of the front surface is covered by a control panel **22**. This ratio is primarily a function of aesthetics, and does not effect the performance of the device **10**. A centralized rocker **24** is provided in the control panel **22** to control an internal switch to activate and deactivate the device **10** and an indicator light **26** is provided above the rocker switch **24** which illuminates when the device **10** is activated and, as will be seen in greater detail hereinafter, flashes when the filtration device **10** has been in operation for a predetermined time period. A plurality of vents **30** are provided around the curved side surface **28** to act as air outlets.

Turning now to FIG. **3**, a rear surface **32** is provided adjacent and integral with the side surface **28**. The rear surface **32** is curved to conform to the shape of the side surface **28**.

In order to facilitate electrical power application, a pair of electrical prongs **34** extend outwardly from the rear surface **32** for operational engagement with a conventional electrical outlet. The electric prongs **34** are each formed of like dimensions, so that the air filtration device may be connected to an electrical outlet without regard to the dimensional differences between the socket openings. Accordingly, the device **10** may be oriented properly, with the prongs **34** above the vents **30**, no matter what orientation a polarized socket is mounted to the outlet E. Further, the prong arrangement allows the device **10** to be mounted in the lower of the two sockets in an outlet pair, without regard to the dimensional differences between the socket openings. The location of the prongs **34** with respect to the top of the housing **12** ensures that the uppermost socket in a socket pair will remain available for use by other devices when the device **10** is in operation, as seen in FIG. **8**.

A bumper member **36** provided below the electrical prongs **34** for abutment with a vertical surface or wall W against which the device **10** is mounted, as seen in FIGS. **7** and **8**. The bumper member **36** assists a user in orienting the device **10** with respect to a wall surface W. Further, the bumper member **36** may be formed from resilient material. A resilient bumper member **36** absorbs and dampens vibrations from the housing **12** to reduce or prevent their transmission to the wall W which reduces the noise associated with an operational air filtration device **10**.

Turning now to FIGS. **4**, **5** and **6**, the internal components of the device **10** are illustrated. It will be appreciated that in order to filter air, an air flow path is defined through the housing **12**, a filter **40** is provided and a device is provided to move the air. As seen in FIG. **5**, the air flow path, illustrated by arrows, is defined by air movement generated within the device **10**, from the air inlet **16**, through the device **10** and outwardly through the vents **30**. An impeller **54** is provided to move air through the device **10**. The impeller **54** is a basket-like structure having two mounting rings **55** separated by a plurality of vanes **57** that are curved to draw air from outside the impeller **54** and drive the air outwardly through the side of the impeller **54**.

The impeller **54** is rotated by an electric motor **46**. As seen in FIG. **5**, the motor **46** includes an armature **56** attached to the impeller **54**. Electrical excitation of the motor **46** causes the armature **56** to rotate, thereby rotating the impeller **54**.

As also seen in FIGS. **4**, **5** and **6**, a filter **40** is provided for filtering incoming air. The filter **40** can be directional in that a particular surface can be facing incoming air so that contaminated air is drawn through the filter **40** in a direction optimal for air filtration. One useful filter **40** includes a front filtration surface **41**, a rear scrim **45** and is charcoal activated. It will be appreciated by those skilled in the filtration art that other filter compositions may be used. In particular, some filters may be configured to remove bathroom odors and some filters may be configured to remove kitchen odors. Other types of filters may include an increased charcoal content for smoke filtration. It is contemplated that various types of filters may be used with the present air filtration device **10** without reducing the effectiveness of any of the filters or the overall filtering efficacy of the device **10**. The filter **40** is formed with a notch **42** in one corner, as will be explained in greater detail hereinafter.

An internal baffle plate **60** is provided to provide a surface for mounting the filter **40** and to direct air inwardly toward the impeller. A conical inner surface **62** is provided in the baffle plate **60** to provide a nozzle effect to increase the effectiveness of the filtration device **10**. A locating surface **43** is formed as a raised rib in a lower corner of the baffle plate **60** corresponding to the notch **42** in the filter **40** for orienting the filter in the housing **12**. An icon **44** is applied to the baffle plate **60** adjacent the locating surface **43**, for visual indication of proper filter orientation. As also illustrated in FIG. **4**, the air filtration device **10** is configured for mounting against an electrical outlet E mounted on a wall W.

As seen in FIGS. **5** and **6**, the air flow path is defined through the housing **12** and illustrated by arrows. Atmospheric air enters the air filtration device **10** through the air inlet grill **16** and then travels through the filter **40** for contaminant removal. With reference to FIG. **4**, the air travels down the conical inner surface **62** of the internal baffle plate **60** and enters a plenum **63** containing the rotating impeller **54**. The impeller **54** draws the air along the flow path to an area within the rotating vanes **57** and the air is directed then outwardly through the rotating vanes **57** through the plenum **63** and eventually out through the vents **30** in the curved side wall **28**.

Another feature of the present invention is the ability to determine in general when the filter **40** should be replaced. Under normal operation, the filter **40** should be replaced after a predetermined period of time. It may be presumed that the time period of filter contamination coincides with the operating period of the impeller **54** and therefore the motor **46**. To that end, a timing circuit **48** is provided in the wiring **50** that connects the switch **25** to the motor **46**. As also seen in FIGS. **5** and **6**, the rocker **24** operates a remotely disposed switch **25**, with the rocker **24** projecting through the control panel **22**. It should be appreciated by those skilled in the art that such a timing circuit is a basic electronic device and can be configured in any number of ways. The timing circuit is also in electrical communication with the indicator lamp **26** which illuminates upon electrical excitation of the motor **46**. When the timing circuit **48** has reached the end of a predetermined time period, the indicator light **26** is caused to pulsate, or flash, which is an indication that the filter **40** should likely be replaced. The timing circuit **48** also includes a reset switch **49** which allows an operator or owner to reset the timer once the filter is replaced. Optionally, the device **10** may be provided without a timing circuit **48** as illustrated in FIG. **6**.

Referring now to FIGS. **7** and **8**, in operation, the air filtration device **10** of the present invention is plugged into an electrical outlet using electrical prongs **34** in a generally conventional manner. The rear surface **32** of the housing **12** is closely adjacent to the electrical outlet E and may abut the

electrical outlet E. The bumper member **36** abuts the wall W or outlet E or indeed, any vertical surface to which the device **10** may be fixed in order to provide proper orientation of the device **10** with respect to the wall surface W and, if the bumper member **36** is resilient, to provide a damping effect for motor vibrations that may be transmitted from the housing **12** during operation. Once a device **10** is against the wall W the rocker **24** is moved into an "on" position, which causes the switch **25** to provide electrical excitation to the motor **46** which, in turn, causes the impeller **54** to rotate, thereby drawing atmospheric air inwardly through the air inlet grill **16**. The atmospheric air is drawn through the filter **40** and is caused to travel along the air flow path as defined in FIGS. **5** and **6**. As the air passes through the filter **40** contaminants are removed and the filtered air travels intermediate the vanes **57** of the impeller **54** and is expelled through the vents **30** formed in the curved side surface **28**. As seen in FIG. **7**, and as will be appreciated by those skilled in the art, the filtered air is dispersed along an approximately 315° curve and the wall W acts as a baffle to enhance air dispersion from the device **10**. Therefore, the air filtration device **10** of the present invention draws air from a generally focused source of contaminated air and provides a dispersed wave of filtered air to enhance the effectiveness of the filter operation. It should be noted that the relationship of the device **10** and the wall W, along with the vent location, is illustrated in FIG. **8**.

As previously stated, the present invention provides a user with visual enhancements with respect to filter replacement. With reference to FIG. **9**, a filter is shown spaced a distance from the baffle plate **60** to which it is to be mounted. As can be seen, the filter **40** includes a notch **42** formed in a lower right hand corner of the filter **40**. The baffle plate **60** includes the icon **44** which is preferably shaped as a keyhole, yet may be shaped in any configuration imaginable. By orienting the notch **42** in abutment with the locating surface **43** and such that the icon **44** is visible through the notch **42** when the filter **40** is in place, as seen in FIG. **10**, the filter **40** is oriented properly with respect to air flow. Should the filter **40** be inserted in a reverse manner, the icon **44** would not be visible, because the notch **42** would not be in a position to allow the user to see the icon **44**. Additionally, the locating surface **43** acts to physically orient the filter **40**. Therefore, the combination of the notch **42**, the icon **44**, and the locating surface **43** allows someone replacing the filter to easily determine when the filter is in proper orientation with respect to air flow.

By the above, the present invention provides a compact air filtration device that provides enhanced effectiveness, the ability to determine when a filter should be replaced, and a visual indication of proper filter orientation with respect to air flow.

It will therefore be readily understood by those persons skilled in the art that the present invention is susceptible of a broad utility and application. Many embodiments and adaptations of the present invention other than those herein described, as well as many variations, modifications and equivalent arrangements, will be apparent from or reasonably suggested by the present invention and the foregoing description thereof, without departing from the substance or scope of the present invention. Accordingly, while the present invention has been described herein in detail in relation to its preferred embodiment, it is to be understood that this disclosure is only illustrative and exemplary of the present invention and is made merely for purposes of providing a full and enabling disclosure of the invention. The foregoing disclosure is not intended or to be construed to limit the present invention or otherwise to exclude any such other embodiments, adaptations, variations, modifications and equivalent arrangements, the present invention being limited only by the claims appended hereto and the equivalents thereof.

We claim:

1. An air filtration device for intake of atmospheric air, removal of contaminants from the atmospheric air, expulsion of filtered air, and configured for operational association with a generally vertically oriented surface, said air filtration device comprising:

a housing defining an air flow path therethrough and having a front surface and a rear surface;

at least one air inlet formed in said front surface;

at least one air outlet formed in said housing intermediate said front surface and said rear surface, said at least one air outlet extending on a side surface located between the front surface and the rear surface for cooperation of said air outlet with a generally vertical surface to which said air filtration device is associated for enhanced dispersion of filtered air expelled through said air outlet;

a filter supported in said air flow path;

an impeller supported by said housing for moving air through said air flow path, said impeller including a central inside area;

a baffle plate supported by said housing for directing air flowing from said air inlet toward said central inside area; and

a motor for driving the impeller, the motor and impeller at least partially supported by the baffle plate.

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